Aerial population survey of common eiders and other waterbirds in nearshore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 3-12 July 2000

By

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SUMMARY

An aerial survey of common eiders and other water birds in coastal habitats along the Arctic Coastal Plain of Alaska, including barrier islands, was conducted for the second consecutive year from 3 to 12 July 2000. Observations were made from a Cessna 206 amphibian (N736) by pilot/observer and observer along the Chukchi and Beaufort sea coastlines. The study area encompassed approximately 1,050 km of shoreline from Omalik Lagoon north and east to Demarcation Bay and an additional 190 and 325 km, respectively of barrier island habitats off Kasegaluk Lagoon and from Point Barrow to Demarcation Bay. Phenologically 1999 was considered late relative to sea ice conditions and 2000 conditions were later still.

A total of 2,649 common eiders (863 indicated breeding pairs) were observed in 2000. These counts were up 95.8 and 50.9 percent, respectively from the 1999 counts of 1,353 birds and 572 pairs. Percent distribution increased near Kasegaluk Lagoon and east of the Canning River while decreasing along the central Beaufort Sea coast**.** The central Beaufort Sea coast and Kasegaluk Lagoon accounted for 28.7 and 34.5 percent of total common eider observations and 49.1 and 13.8 percent of indicated breeding pairs. Other waterbird species observed and their change from 1999 included long-tailed ducks 5726(+17.1%), glaucous gull 3345(-25.0%), Pacific brant 1411(-39.4%), surf scoter 11113(+436.1%), Canada goose 659(-57.6%), northern pintail 779(-38.6%), greater scaup 944(-6.6%) and king eider 488(-45.8%).

PURPOSE

The goal of this survey was to provide information necessary to monitor the status and trends of breeding common eiders in northern Alaska. Based on migration counts at Point Barrow (Suydam et.al. 1997), this population may have significantly declined. The project objectives are:

1) Obtain annual population indices for common eiders along coastal segments and on islands of the Arctic Coastal Plain (ACP).

2) Estimate the population size, composition and trend in common eiders breeding on, or adjacent to, barrier islands of the central Beaufort Sea coast where potential impacts related to petroleum development are expected to increase.

3) Determine if weather or ice phenology provide indices to coordinate the survey with late egg laying/early incubation in common eiders.

4) Obtain a companion videographic survey to estimate the number of common eider nests on central ACP barrier islands and provide ratios of breeding pairs to nests.

5) Estimate species composition, numbers and distribution of other waterbirds along the coastline of the ACP.

INTRODUCTION

The common eider is a species of concern in Alaska primarily due to a possible spring migration decline of over 50 percent over the past 20 years at Point Barrow and reduced numbers or breeding birds at subarctic and arctic breeding sites (Suydam et. al. 1997, USFWS 1999). Breeding distribution extends from southcentral Alaska and the Aleutian Islands north and east along the ACP to the Canadian arctic (Bellrose 1976, Gabrielson and Lincoln 1959, Johnson and Herter 1989, Palmer 1976). Dau and Taylor (2000) provided a brief synopsis of size and trends in the Arctic Alaska common eider based on migration studies and a discussion of potential impacts on common eider populations in western and northern Alaska from predation, subsistence hunting and related lead poisoning and disturbance, habitat loss and impacts associated with petroleum exploration and development.

This report summarizes the second consecutive years aerial survey effort to estimate the population size, demography and distribution of common eiders along the ACP from Omalik Lagoon along the Chukchi Sea to Demarcation Bay along the Beaufort Sea. Previous ground based studies (Moitoret 1998, Moitoret and Suydam 1997, Divoky 1978, Johnson and Richardson 1981, Johnson et. al. 1992, Johnson and Herter 1989, L. Noel pers. comm.) conducted within the survey area provided site specific data on population size and/or number of nests which helped identify areas of emphasis. However, there have been no quantitative aerial surveys to annually estimate the common eider population size and composition along the entire ACP. Johnson and Herter (1989) estimated that probably no more than 2,000-3,000 common eiders nest along the Alaskan Beaufort Sea coast and Moitoret and Suydam (1997) reported 266 nests in a sample of plots at Kasegaluk Lagoon, Alaska. There are no published estimates of common eider population size or numbers of nests at lower density sites within the survey area. Ground surveys indicated considerable interannual variability in number of nests; however, variability in the numbers of breeding pairs is unknown.

METHODS

The survey was flown from 3-12 July 2000, during early incubation when male eiders are in the vicinity breeding sites. Males gather into flocks and eventually disperse from breeding areas as incubation proceeds so survey timing is important to determine the number and distribution of breeding pairs. To better coordinate survey timing with breeding chronology, ground observations of breeding pairs and nest initiation were provided (P. Flint, pers. comm., L. Noel, pers. comm.).

The survey was conducted in a amphibious Cessna 206 flown at approximately 110 knots and an altitude of 45 meters ASL/AGL. Observations, made out both sides of the aircraft by the pilot/observer (left) and observer (right), were entered directly into laptop computers using remote microphones. Data were recorded and transcribed using a program designed by Jack Hodges (USFWS-Migratory Bird Management, Juneau). A meandering flight route followed mainland and barrier island shorelines and adjacent nearshore waters. Flights were conducted in calm or light winds during mid-day to maximize height of the sun-angle and reduce glare and increase the visibility of birds on the water.

The survey area included 30 shoreline segments and 18 islands or island groups identified on

1:250,000 scale topographic maps (Figs. 1 and 2, Appendix 1). Insular areas along the central Beaufort Sea coast which were later included in the companion videographic nest survey were identified on 1:63,360 scale topographic maps. Maps were consulted primarily to identify segment start and stop points. General observations on habitat and survey conditions, opportunistically recorded by the pilot, were compared with sea surface analyses prepared by the National Weather Service (Fig. 3). For waterfowl species, sex and age of single birds and composition of flocks were determined whenever possible. Observations of common eiders and other species were summarized by barrier island and shoreline survey segments (Tables 1 and 2) and for the total survey area (Table 3). The distribution and composition of common eiders and the number of indicated breeding pairs (single males+pairs) throughout the survey area was determined to estimate the proportion of breeding birds and total population size (singles+2x pairs+flocks) (Table 4). The number of indicated breeding pairs of common eiders along barrier islands of the central Beaufort Sea was compared with the average number of nests from ground nesting surveys of the same islands (Table 5).

The companion aerial videographic project was initiated in 1999 (Anthony 1999) and repeated 10 July 2000 to estimate the number of common eider nests on a sample of barrier islands of the central Beaufort Sea. The videographic survey was flown in the same aircraft used during the preceding population survey. Ground surveys on selected islands, being conducted by USGS-BRD and LGL Alaska Research Associates, Inc., may provide useful air:ground ratios for birds and nests.

STUDY AREA/CONDITIONS

Omalik Lagoon to Point Barrow

Coverage and a physical description of this and following portions of the survey area are described by Dau and Taylor (2000).

Ice coverage in estuaries and offshore was more extensive in 2000 than 1999. Omalik Lagoon was free of ice; however, shore fast ice extended seaward to 0.8-1.2 km with open water beyond. Shore fast sea ice extended 4.8-8.0 km offshore from the south end of Kasegaluk Lagoon north to Point Lay and was essentially continuous to 90 km south of Point Barrow. Fog precluded following the coastline north to Point Barrow and east to Cape Halkett. Off northern Kasegaluk Lagoon, there was approximately 1.2 km of floating ice onshore with solid ice beyond. With the exception of some local floating ice near Icy Cape, the southern portion of Kasegaluk Lagoon was ice free. East of Icy Cape the lagoon was >95 percent ice covered. The far northern section of Kasegaluk Lagoon was approximately 40 percent ice covered. Portions of Peard Bay were obscured by fog but ice conditions appeared overall >60 percent.

Point Barrow to the Colville River Delta

The coastline from 90 km south of Point Barrow north and east to Cape Halkett were not surveyed due to persistent fog throughout the survey period (3-12 July 2000). Nearshore waters were ice free in Harrison Bay and off the Colville River Delta.

Colville River Delta to the Canning River Delta

Simpson Lagoon from Beechey Point west to Oliktok Point was 50-80 percent ice covered. West of Oliktok Point, Simpson Lagoon was ice free to >4.8 km north of the barrier islands. Gwydyr Bay was ice free. Continuous sea ice was present from 4.8-8.0 km north of Long Island to Stump Island and West Dock. Nearshore waters of Stefansson Sound, Point McIntyre east to Foggy Island Bay, were essentially ice free. The eastern 75 percent of Foggy Island Bay along a north-south line was covered with solid to broken ice. East of Foggy Island Bay, open water was found along the shore and to within 0.8 km offshore to 8.0 km west of Bullen Point. From Bullen Point to Point Thompson there was <3 m of open water along the mainland shore. East to Flaxman Island there was 3-50 m of open water along the shore and continuous ice elsewhere inside the barrier islands. A 1-2 km area of open water between Flaxman Island and Brownlow Point.

Thetis Island was surrounded by open water. Spy Island had shore fast ice to the north and open water to the south. The Leavitt/Pingok island area had shore fast ice to the north and 50-100 m open water to the south. Egg and Stump islands were surrounded by open water with the exception of the eastern 50 percent of Stump Island which had shore fast ice to the north. Egg Island to Seal Island (Northstar) was 50 percent broken ice. The Midway Islands (Reindeer and Argo islands), Cross Island and the McClure Islands (Narwhal to Karluk islands) were surrounded by ice. Variable areas of nearshore open water, 15-50 m in width, were found around the Midway and McClure groups while only 5-15 m wide areas were open at Cross Island. Continuous shore fast ice persisted north of islands in the Stockton, Maguire and Flaxman island groups. Approximately 1.2 km of open water was found north of barrier islands from Brownlow Point to the Canning River Delta with nearshore waters to the south ice free.

Canning River Delta to the Canadian Border

Approximately 1.2 km of open water, with one lead to 2.4 km offshore, was found north of barrier islands from the Canning River Delta to Konganevik Point. Continuous ice appeared to persist $\leq$2.4 km offshore from the Canning River Delta east to Demarcation Bay. Nearshore waters south of barrier islands to approximately 8 km west of Konganevik Point were ice free with the remainder 90 percent ice covered. Camden Bay was shore fast ice except to 2 km east of Konganevik Point where up to 400 m of open water extended from shore. Arey, Kaktovik, Jago, Tapkaurak and Oruktalik lagoons were approximately 80 percent ice covered. Pokok Bay was approximately 50 percent ice covered. The Beaufort Lagoon system (Angun to Siku lagoons) was approximately 80 percent ice covered. Demarcation Bay had approximately 20 percent ice cover.

RESULTS/DISCUSSION

The 3-12 July 2000 survey was accomplished during mid-incubation for those common eiders breeding along the central Beaufort Sea coast. Peak onset of incubation was estimated to occur 24-25 June, first piping eggs on 12-14 July and peak hatch 19-20 July (P. Flint, pers. comm.).

Data are lacking to suggest that common eiders breeding along the Chukchi Sea coast would differ phenologically from Beaufort Sea breeders. However; even if such differences did occur with more southerly pairs breeding slightly earlier, we feel survey timing fell mid-way within the incubation period in 1999 and 2000.

A total of 2,649 common eiders, including 863 indicated breeding pairs, were observed in 2000 (Figs. 1 and 2, Table 3 and 4). Total birds and indicated breeding pairs were up 95.8 and 50.9 percent, respectively from the 1999 counts of 1,353 birds and 572 pairs. A total of 622 single adults was up 46.7 percent from the 424 seen in 1999; however, the proportions (94.9% males: 5.1% females) were similar. Single adults accounted for 23.5 percent of total observations compared to 31.3 percent in1999. Flocked adults in 2000 totaled 1469 (55.5% of total), nearly a three-fold increase over the 511 (37.8% of total) observed in1999. Males predominated (1.1:1) in flocks this year while females predominated (2:1) in 1999. Equal sex ratios observed in large samples of flocks at Barrow (Johnson 1971 and Suydam et. al. 1997) and the results of this survey in 1999 (Dau and Taylor 2000) suggest spring migration is composed primarily of breeding pairs.

Subadult males made up 0.3 and 1.3 percent of total observations in 2000 and 1999, respectively. During both years, the few sightings of subadult males were along the Chukchi Sea coastline. We noted variability in shading of female plumage but cannot determine if this is related to age. Schamel (1978) observed some non-breeding (possibly subadult) females at Egg Island but did not discuss their proportion in relation to breeding adults and makes no mention of subadult males.

As in 1999 (Dau and Taylor 2000), totals and indicated breeding pairs of common eiders were most numerous along the central Beaufort Sea coast (760 birds, 28.7% of total; 424 indicated pairs, 49.1% of total) and near Kasegaluk Lagoon (914 birds, 34.5% of total; 119 pairs, 13.8% of total) (Tables 1, 2 and 4). In 2000, the relative proportion of total common eiders observed and breeding pairs, declined along the central Beaufort Sea coastline but increased near Kasegaluk Lagoon (Table 5). We observed only seven birds and one breeding pair at Peard Bay in 2000 versus 106 birds and 36 pairs in 1999. From the Canning River to Demarcation Bay, we observed 956 birds and 319 indicated breeding pairs in 2000 versus 299 birds and 75 pairs in 1999.

Climatic conditions, extent of ice cover, and predation can all interact to affect the number and distribution of nesting common eiders (D. Schamel, pers. comm.). In all survey segments, ice conditions were more severe in 2000 than 1999. Based on limited resightings of marked breeding females, common eiders are believed to exhibit strong fidelity to nesting areas (S. Johnson, pers. comm.). The large increase in birds and indicated breeding pairs in 2000 may be due to the more severe ice conditions which could have precluded migration to more easterly breeding areas.

Numbers of common eider nests observed on barrier islands of the central Beaufort Sea coast over the past 3 decades were extremely variable (Appendix 2). Without comparable data on climate and ice conditions, hypotheses on potential causes are problematic. Coordinated annual

aerial and ground surveys conducted the past 2 years will help qualify our interpretations. When insular nesting sites are accessible by ice, predation by bears and foxes can be extensive (Johnson et. al. 1987, Schamel 1974, Moitoret 1998, Moitoret and Suydam 1997, Johnson and Herter 1989) and the resulting distributional characteristics of failed breeders is unknown. Flocking by non and failed-breeding adults could dramatically affect aerial surveys conducted during early incubation. Likewise, these surveys could be affected if more easterly breeders are short-stopped in their migration by heavy ice conditions. Severe ice conditions and limited open water are known to result in later migration, lower nesting effort, increased reproductive failures or direct mortality (Barry 1960, 1967, 1968). Several dead or incapacitated common eiders were reported in the Prudhoe Bay area in 2000 (L. Noel, pers. obs.).

RECOMMENDATIONS

The size and distribution of the common eider breeding population based on this survey along the ACP showed considerable annual variability between 1999 and 2000. Factors such as climate and ice conditions, predator abundance and distribution and potential disturbance associated with offshore oil and gas exploration and development are important but difficult to quantify over the large geographic area surveyed. Appropriate survey timing in coordination with ground surveys are providing a useful index of annual population size and trend along the central Beaufort Sea coastline.

This was a new survey in 1999 and increased attention to segment boundaries and observer orientation was required of the pilot. These duties were lessened in 2000 however we do not feel that these factors biased observations of common eiders in either year. Common eiders are large, distinctive and uniquely distributed within the survey area near salt water, primarily in colonies on islands and peninsulas (Johnson et.al. 1987). They could be most easily confused with similarly marked but smaller spectacled eiders which breed inland in fresh-water habitats as scattered pairs. We observed few spectacled eiders, mostly along the Chukchi Sea coastline.

Specific recommendations are:

1) Conduct an annual aerial survey timed to coincide with onset of incubation to assess the distribution and abundance of total birds and indicated breeding pairs.

2) Collaborate with other researchers to obtain ground survey data of birds and nests within the survey area to provide visibility indices for ocular and videographic surveys.

3) Conduct an annual aerial videographic survey to estimate numbers of nests on barrier islands along the central Beaufort Sea coastline.

4) Assess ice conditions in estuarine habitats and offshore in the Chukchi and Beaufort seas.

5) Review plumage characteristics of subadult and adult common eiders to assess the capability of detection during aerial surveys.

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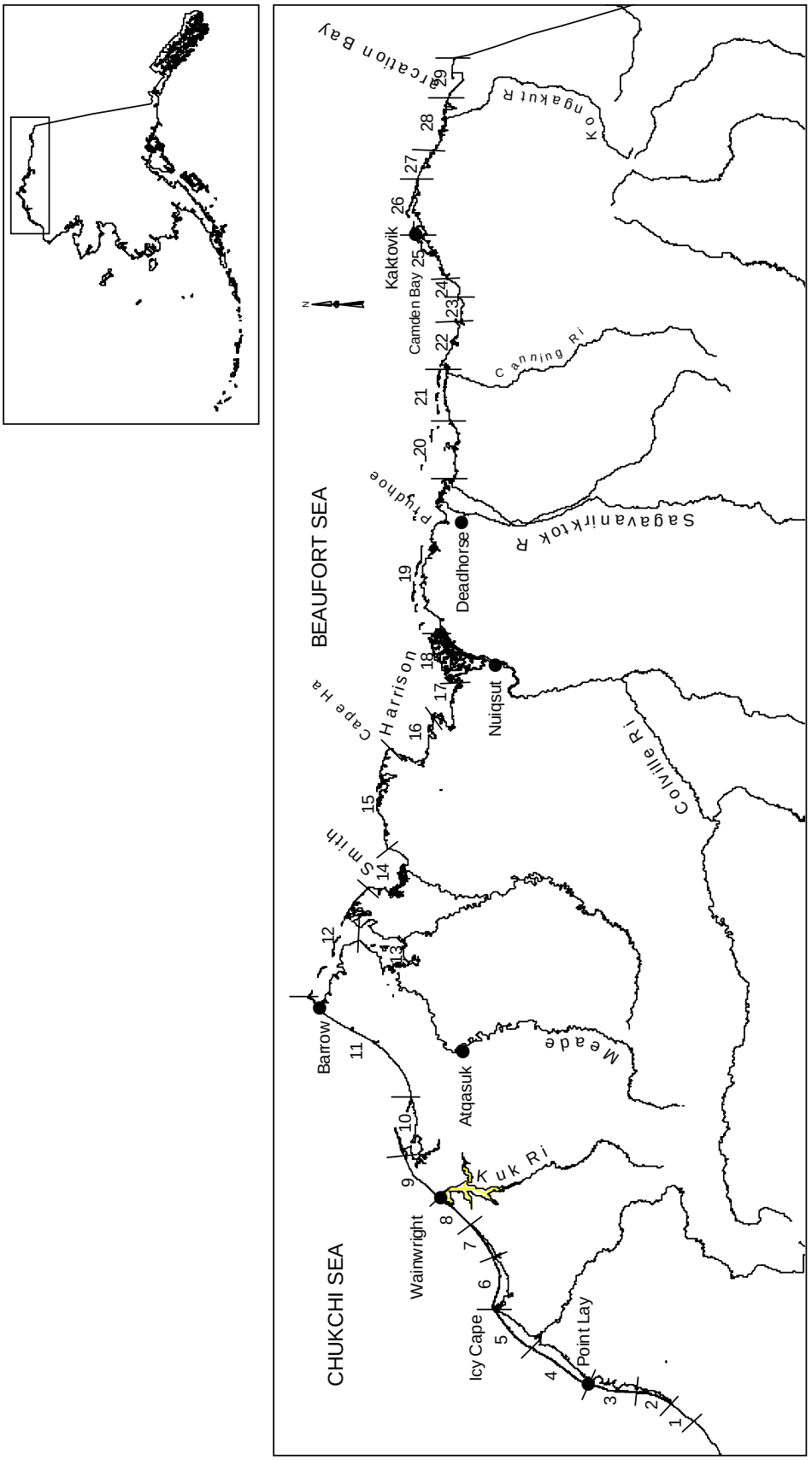

Fig. 1. Location of aerial survey segments searched for common eiders along the Arctic Coast, Alaska

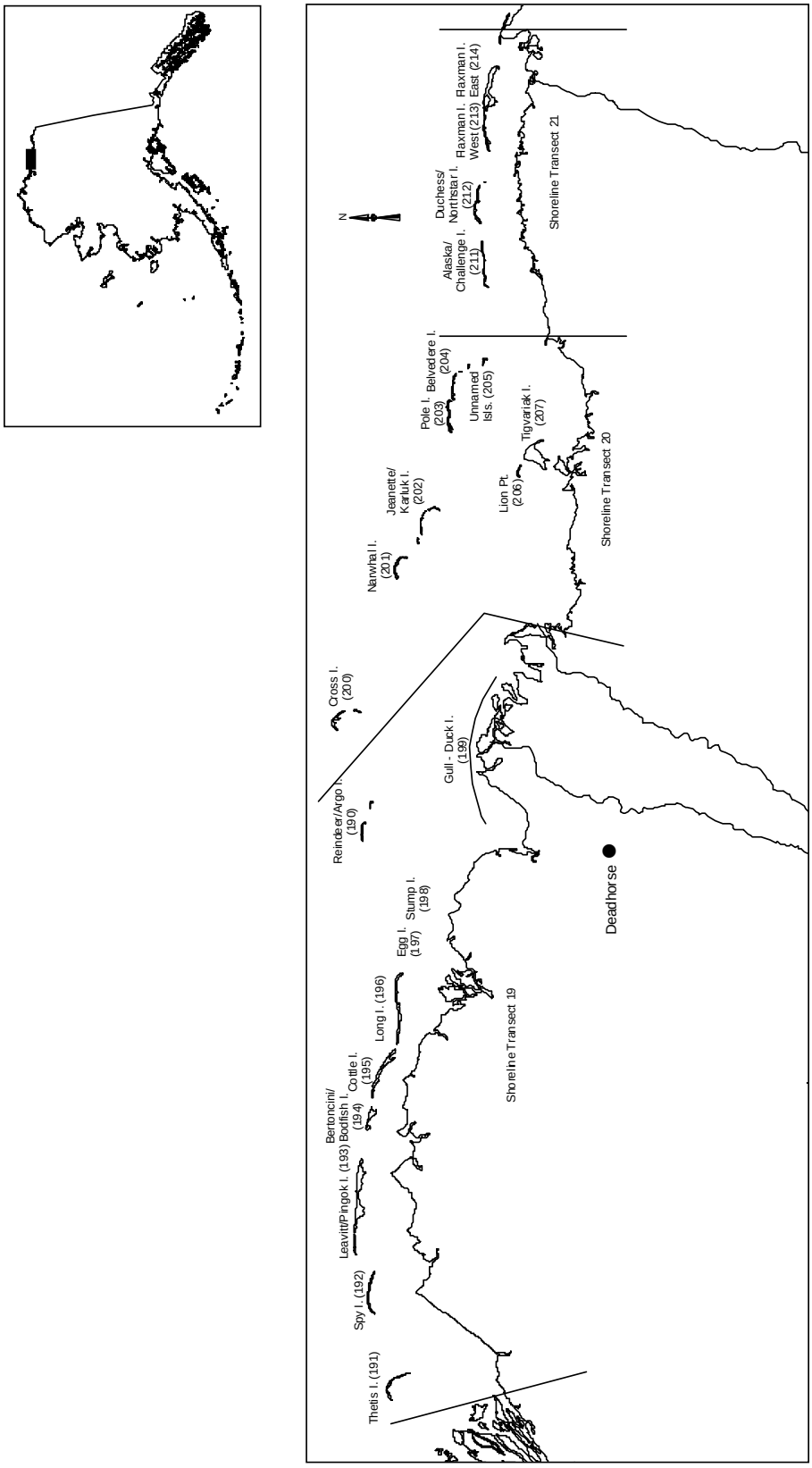

Fig. 2. Survey segments, including coastline and barrier islands, along the central Arctic Coastal Plain, Alaska.

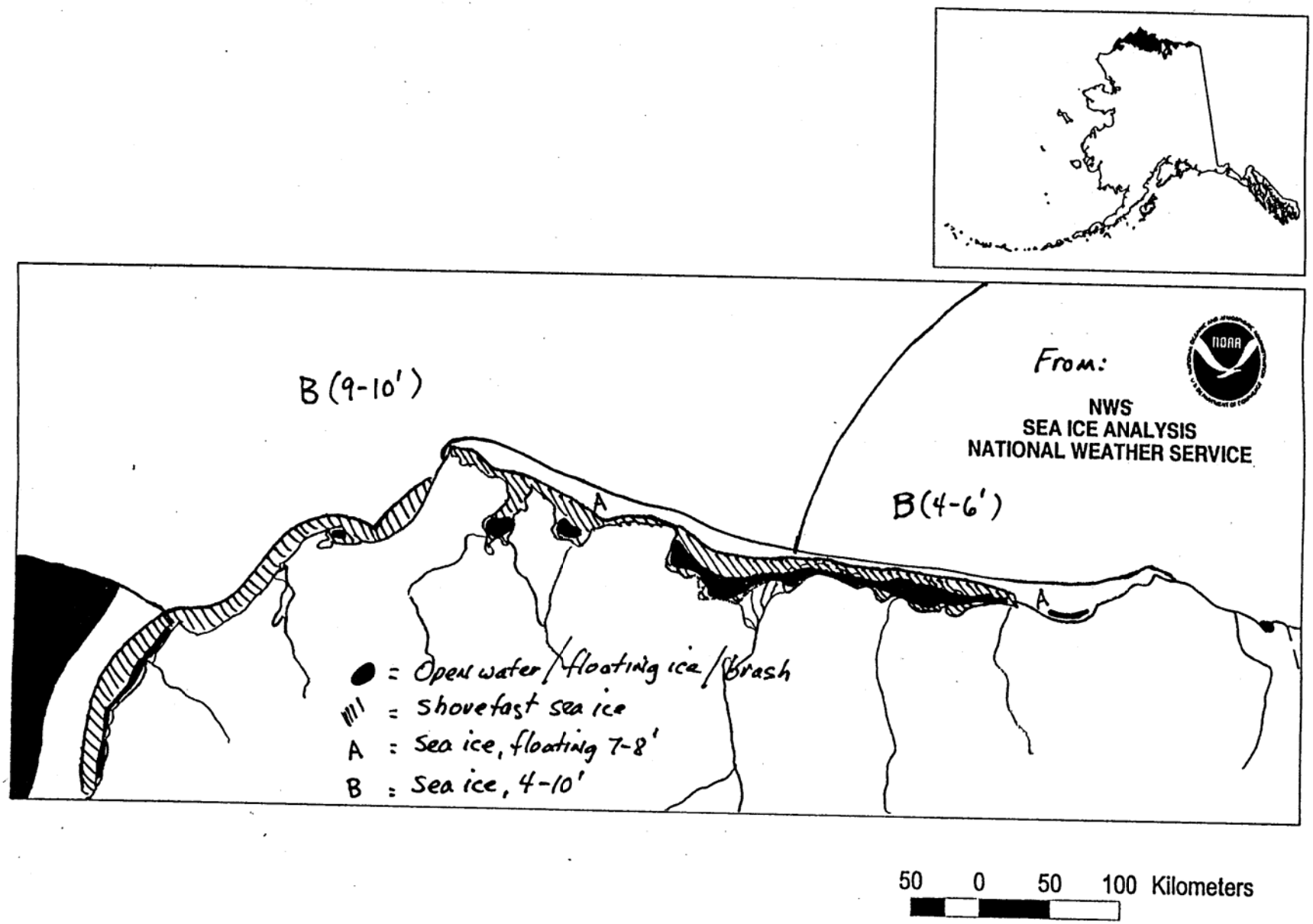

Figure 3. Sea ice conditions in early July along the Arctic Coastal Plain, 2000.

Table 1.Species totals by segment along barrier islands of the ACP, 3-12 July, 2000.

	Segment Number																				
Species	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	211	212	213	214	Total
ARTE			1	1									3			2		2			9
BLBR		5							2	75											82
BLGU										4											4
COEH			3		1	1				1	6	2	2	1	2		12	4	1		36
COEI	19	3	7	2	7		4	45	38	17	36	12	1	42	6	20	17	34	6	124	440
GLGU	6	4	5		2	1	3	32	37	283	575	2	1	12	3	3	8	6	6		989
GRSC		25															3				28
JAEG				1																	1
KIEI					2		1										8			10	21
NOPI										14											14
LTDU	14	88	168	37			30	15		51	70	90	7	131	65	66	79	34	11	110	1066
PAJA				2																	2
PALO				6	2	1			2	3		2				1	6	3	6		32
RBME			15		1				2	10	3									6	37
RTLO					1					9			1			1		1		2	15
SAGU				3		1															4
SPEI																				1	1
SUSC		8		2		4			5	15										2	36
WFGO				26			4														30
WWSC							1			9										72	82
YBLO				1																	1

Table 2. Species totals by segment along ACP coastline, 3-12 July, 2000.

	Segment Number																									
Species	1	2	3	4	5	6	7	8	9	10	11	16	17	18	19	20	21	22	23	24	25	26	27	28	29	Total
ARTE	1	50	20	18	6	12				4						2						5				118
BLBR	15	3	12	2	278	46				30		369	160	27	113		58				176	35			5	1329
BLGU															4											4
CAGO												540	35		8	54	18	2							2	659
CEJV					3	5																				8
COEH	6			11	42	30				6	3		3		61	6	13	39		10	17	39			8	294
COEI				113	184	518	8			1					94	92	18	369	22	84	151	170	6		41	1871
GLGU	18	68	20	58	151	229	20	65	30	26	8	36	327	33	519	258	23	35	14	5	94	269	11	5	34	2356
GRSC	20		40	6								200				102			60	30	217	171	45		25	925
JAEG		11																								11
KIEH			6			26							1		4	7	8					3	2		4	61
KIEI	12		1	2		63				200					31	20	13	42	2		2	9		9		406
LTJA												3														3
NOPI		578		6		70	1	11		2		35			18		14		10	10	5	5				765
LTDU	8	139	31	119	368	477	40	47		180	36	2			124	513	45	208	67	35	78	1657	231	103	152	4660
PAJA		3	1				1						1										1			7
PALO	18	19	9	1	1	44	18	20	7	110	17	1	1		26	8	5	16	7		2	50	10	2	5	397
POJA		1	2																							3
RBME	2	1	5			33				2	1				61	13	8	53	159	2	33	1453	47	2	73	1948
RTLO	27	16	23	7	7	6		1			1		1		15	1	1	19	2	2	3	40		8	3	183
SACR																							2			2
SAGU																										0
SMSH																						3				3
SNGO			11									881				94										986
SPEI	12			2																						14
SUSC	60	25	15	40	12	117		45	25	5					598	460	820	332	65	1148	3075	2416	1263	344	212	11077
TUSW		2	2			39						10		2		4	4	5	2		2	2			10	84
WFGO	27	53	6	8	4	103	1					893	81		32						30				1	1239
WWSC																20		64	23	205	111	11	19	9	221	683
YBLO						10				14	1	3			2	1	1	1	2	1		11	2	1		50

Table 3. Species totals for all areas, ACP, 3-12 July 2000.

	Total Birds Observed		
Species	Shoreline	Barrier Isl.	Overall
ARTE	118	9	127
BLBR	1329	82	1411
BLGU	4	4	8
CAGO	659		659
CEJV	8		8
COEH	294	36	330
COEI	1871	440	2311
GLGU	2356	989	3345
GRSC	916	28	944
JAEG	11	1	12
KIEH	61		61
KIEI	406	21	427
LTJA	3		3
NOPI	765	14	779
OLDS	4660	1066	5726
PAJA	7	2	9
PALO	397	32	429
POJA	3		3
RBME	1948	37	1985
RTLO	183	15	198
SACR	2		2
SAGU		4	4
SMSH	3		3
SNGO	986		986
SPEI	14	1	15
SUSC	11077	36	11113
TUSW	84		84
WFGO	1239	30	1269
WWSC	683	82	765
YBLO	50	1	51

Table 4a. Common eider sex and age composition and totals by segment, ACP, 2000.

TRANSECT	SINGLES			PAIRS		FLOCKED BIRDS		TOTAL[3]
	AdultMale	Juv. Male	Female	No.	Indicated Total[1]	Total	Male:Female[2]	
1						6	0:06	6
2								0
3								0
4	3		2	7	10	106	46:15:00	125
5	28	3	5	30	58	132	35:72	228
6	19	5	3	27	46	472	237:205	553
7	2			3	5			8
8								0
9								0
10	1				1	6	0:6	7
11								0
12								NA
13								NA
14								NA
15								NA
16								NA
17						3	0:03	3
18								0
19	58		2	18	76	59	0:59	155
20	31			14	45	39	33:06:00	98
21	10			4	14	12	0:12	30
22	77			26	103	279	120:49:00	408
23	6			8	14			22
24	4				4	90	50:40:00	94
25	65		2	18	83	65	50:15:00	168
26	52		1	28	80	100	62:38:00	209
27	6				6			6
28								0
29	17		1	12	29	7	0:07	48

[1] Single males+pairs = Indicated total pairs.

[2] Flocks from which sex ratios were obtained.

[3] Total= singles+2x pairs+ flocks.

Table 4b. Common eider sex and age composition and totals by segment, ACP, 2000.

TRANSECT	SINGLES			PAIRS		FLOCKED BIRDS		TOTAL[3]
	AdultMale	Juv. Male	Female	No.	Indicated Total[1]	Total	Male:Female[2]	
190	13			3	16			19
191	1			1	2			3
192	5		3	1	6			10
193				1	1			2
194	1		1	3	4			8
195			1					1
196	4				4			4
197	15			6	21	18		45
198	30			4	34			38
199	9		1	4	13			18
200	12		2	12	24	4	0:04	42
201	4		2	4	8			14
202	1				1	2	0:02	3
203	13		1	12	25	5	5:00	43
204	4			1	5	2	0:02	8
205	8			6	14			20
211	7			5	12	12	0:12	29
212	14		4	10	24			38
213	6		1		6			7
214	64			5	69	50	25:25:00	124

[1] Single males+pairs = Indicated total pairs.

[2] Flocks from which sex ratios were obtained.

[3] Total= singles+ 2x pairs+ flocks.

Table 5. Proportional distribution of common eiders along the ACP, 1999-2000.

AREA	1999		2000	
	Total Birds(%)	Ind. Pairs(%)	Total Birds(%)	Ind. Pairs(%)
Kasegaluk Lagoon	176 (13.0)	69 (12.1)	914 (34.5)	119 (13.8)
Peard Bay	106 (7.8)	36 (6.3)	7 (0.3)	1 (0.1)
Central Beaufort Sea Coast	542 (40.1)	378 (66.1)	760 (28.7)	424 (49.1)
Canning R.- Demarcation Bay	299 (22.1)	75 (13.1)	956 (36.1)	319 (37.0)
Other areas[1]	230 (17.0)	14 (2.5)	12 (0.5)	0
TOTALS	1353(100.0)	572(100.0)	2649(100.0)	863(100.0)

[1] 8 survey segments. Six omitted in 2000 (fog). In 1999, 9 birds were observed in these 6 segments.

Appendix 1. Survey segment descriptions, ACP coastal survey, 1999-2000.

SEGMENT	DESCRIPTION
1	Omalik Lagoon to the south end of Kasegaluk Lagoon
2	South end of Kasegaluk Lagoon to Naokak
3	Naokak to Point Lay
4	Point Lay to Ututok Pass
5	Ututok Pass to Icy Cape
6	Icy Cape to Nokotlek Point
7	Nokotlek Point to Kilimanta (north end of Kasegaluk Lagoon)
8	Kilimanta to Wainwright
9	Wainwright to the start of Peard Bay
10	Peard Bay
11	Peard Bay to Point Barrow
12	Barrier islands from Point Barrow to Cape Simpson
13	Dease Inlet
14	Cape Simpson to Drew Point, including Smith Bay
15	Drew Point to Cape Halkett
16	Cape Halkett to Atigaru Point
17	Atigaru Point to Nechelik Channel (Colville River)
18	Colville River Delta
19	Coastline from the east end of Colville River Delta to the Sagavanirktok River Delta
20	Coastline from Foggy Island to Bullen Point, including Lion Point and Tigvariak Islands
21	Coastline from Bullen Point to Brownlow Point
22	Coastline and barrier islands from Brownlow Point to Konganevik Point
23	Konganevik Point to Collison Point
24	Collison Point to Anderson Point
25	Coastline and barrier islands from Anderson Point to Kaktovik
26	Coastline and barrier islands from Kaktovik to Pokok Lagoon
27	Pokok Lagoon to Angun Point
28	Angun Point to Siku Point
29	Siku Point to Demarcation Bay

Appendix 1 (con'd). Survey segment descriptions, ACP coastal survey, 1999-2000.

SEGMENT	DESCRIPTION
190	Reindeer and Argo islands
191	Thetis Island
192	Spy Island
193	Leavitt and Pingok islands
194	Bertoncini and Bodfish islands
195	Cottle Island
196	Long Island E/W
197	Egg Island
198	Stump Island
199	Gull, Niakuk, Howe and Duck islands
200	Cross and unnamed island
201	Narwal Island
202	Jeanette and Karluk islands
203	Pole Island
204	Belvedere Island
205	Unnamed islands east of Belvedere Island
211	Challenge and Alaska islands
212	Duchess and North Star islands
213	Flaxman Island W
214	Flaxman Island E

Appendix 2. Number of common eider nests on barrier islands of the central Beaufort Sea coast.

ISLAND	1970-76[1]			1978-80, 82-91[2]			1995[3]	1999[5]	2000[5]	2000[6]
	Av.	Range	n[4]	Av.	Range	n[4]	n	n	n	n
Thetis	22	14-38	7	66.4	27-112	8		32part	37	-
Spy	2.6	5-Jan	7	13.1	Feb-30	8		26	-	40
Leavitt/Pingok	1.7	0-3	7	3.8	0-14	6		0	-	0
Bertocini/Bodfish	0	0	7	0.4	0-1	5		0	-	2
Cottle	3	0-6	7	3	0-7	7		4	-	5
Long E/W	7.1	25-Feb	7	30	Jan-36	8	24	15	-	53
Egg E/W	16.9	Aug-35	7	59.3	Aug-87	9	60	79	-	109
Stump	2.6	0-10	7	61.5	5-152	10	80		-	156
Gull	0	0	6	1	0-2	3			-	-
Niakuk	4.6	12-Jan	7	5	5	1			-	-
Howe	0	0	6						-	-
Duck	2.6	0-4	7						-	-
Reindeer	0.6	0-4	7	3.3	0-9	6		11	21	-
Argo	0	0	7	3.3	0-6	7			-	-
Cross/Noname	87.9	27-139	7	181.6	60-256	7			-	-
Narwhal	8.3	Feb-33	7	48.4	30-63	7		34	73	-
Jeanette/Karluk	3.3	0-5	7	23.3	0-28	7		20	25	-
Pole	29.1	Apr-64	7	113.9	0-215	7			166	-
Belvedere	4.3	10-Jan	7	9.7	30-Jan	6			2	-
Challenge/Alaska	3.1	0-12	7	39.8	Mar-45	8			-	74
Duchess/Northstar	1.7	0-2	7	33.6	Apr-42	7			-	141
Flaxman W	3.7	0-7	7	0.8	0-2	5			-	2
Flaxman E									-	1

[1] A. Gavin data 1970-75, G. Divoky data 1976.
[2] C. Moitoret data 1978-80, 1982-91.
[3] D. Troy data.
[4] Number of years surveyed.
[5] L. Noel, LGL, Inc. preliminary data.
[6] P. Flint, USGS-BRD data. Stump Island east end only.

Appendix 3a. Number of indicated breeding pairs of common eiders on barrier islands of the central Beaufort Sea coast, 1999-2000.

ISLANDS (Segment No.)	Indicated Breeding Pairs					AVERAGE NO. PAIRS (±1SE)
	1999		2000			
	No.	%	No.	%	% change from 1999	
Reindeer/Argo (190)	-	-	16	5.5	-	-
Thetis (191)	9	2.4	2	0.8	-77.8	5.5±9.7
Spy (192)	14	3.7	6	2.1	-57.1	10.0±11.1
Leavitt/Pingok (193)	0	-	1	0.4	100	0.5±1.4
Bertocini/Bodfish (194)	0	-	4	1.4	400	2.0±5.5
Cottle (195)	0	-	0	-	0	0
Long E/W (196)	21	5.6	4	1.4	-81	12.5±23.6
Egg E/W (197)	42	11.1	21	7.3	-50	31.5±29.1
Stump (198)	9	2.4	34	11.8	377.8	21.5±34.6
Gull/ Niakuk/ Howe/Duck (199)	45	11.9	13	4.5	-71.1	29.0±44.4
Cross/Noname (200)	26	6.9	24	8.3	-7.7	25.0±2.7
Narwhal (201)	31	8.2	8	2.8	-74.2	19.5±31.9
Jeanette/Karluk (202)	14	3.7	1	0.4	-92.9	7.5±18.0
Pole (203)	49	13	25	8.7	-49	37.0±33.3
Belvedere (204)	1	0.3	5	1.7	400	3.0±5.5
Unnamed (205)	0	-	14	4.8	1400	7.0±19.4
Challenge/Alaska (211)	80	21.2	12	4.2	-85	46.0±94.2
Duchess/Northstar (212)	26	6.9	24	8.3	-7.7	25.0±2.7
Flaxman W (213)	6	1.6	6	2.1	0	0
Flaxman E (214)	5	1.3	69	23.9	138	37.0±88.7
TOTAL	378		289		-23.5	333.5±123.3

Appendix 3b. Total common eiders observed along barrier islands of the central Beaufort Sea coast, 1999-2000.

ISLANDS (Segment No.)	Total Birds					AVERAGE NO. BIRDS (±1SE)
	1999		2000			
	No.	%	No.	%	% change from 1999	
Reindeer/Argo (190)	-	-	19	4	-	-
Thetis (191)	14	2.7	3	0.6	-78.6	8.5±15.2
Spy (192)	18	3.5	10	2.1	-44.4	14.0±11.1
Leavitt/Pingok (193)	0	-	2	0.4	200	1.0±2.8
Bertocini/Bodfish (194)	0	-	8	1.7	800	4.0±11.1
Cottle (195)	0	-	1	0.2	100	0.5±1.4
Long E/W (196)	26	5	4	0.8	-84.6	15.0±30.5
Egg E/W (197)	45	8.6	45	9.5	0	45.0±0
Stump (198)	12	2.3	38	8	217	25.0±36.0
Gull/ Niakuk/ Howe/Duck (199)	71	13.6	18	3.8	-74.6	44.5±73.5
Cross/Noname (200)	49	9.4	42	8.8	-14.3	45.5±9.7
Narwhal (201)	45	8.6	14	2.9	-68.9	29.5±43.0
Jeanette/Karluk (202)	17	3.3	3	0.6	-82.4	10.0±19.4
Pole (203)	64	12.3	43	9	-32.8	53.5±29.1
Belvedere (204)	1	0.2	8	1.7	700	4.5±9.7
Unnamed (205)	0	-	20	4.2	2000	10.0±27.7
Challenge/Alaska (211)	104	19.9	29	6.1	-72.1	66.5±103.9
Duchess/Northstar (212)	33	6.3	38	8	15.2	35.5±6.9
Flaxman W (213)	12	2.3	7	1.5	-41.7	9.5±6.9
Flaxman E (214)	11	2.1	124	26.1	1027	67.5±156.6
TOTAL	522		476		-8.8	499.0±63.8